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The deduction of fine structural details of asymmetric nanofiltration membranes using theoretical models

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Abstract

Asymmetric cellulose acetate nanofiltration (NF) membranes were prepared at different shear rate between 152.0 and 506.67 s^{-1} to investigate the effect of casting shear rate on the fine structural details of the membrane and membrane performance by using sodium chloride solution. The experimental data is modeled based on the pore flow, solution–diffusion mechanisms and the extended Nernst–Plank equation. The Spiegler–Kedem membrane transport model was used to evaluate the membrane parameters such as reflection coefficient, and solute permeability, P_s. The fine structural details of the nanofiltration membrane were evaluated in terms of effective pore radius r_p, effective charge density X_d, ratio of effective membrane thickness to membrane porosity. The measurement was conducted using steric-hindrance pore (SHP) model. The effective charge density X_d, was determined using Teorell–Meyer–Sievers (TMS) model. The modeling results show that, the obtained values were in the range of the commercial available NF membranes.

Keywords: Nanofiltration; Modeling; Nernst–Plank equation; Steric-hindarance pore

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